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18P. CMMI (SW, DEV, SVC) Compliance of SDLCs:

Manuel Mora
Autonomous University of Aguascalientes, mmora@securenym.net

Rory V. O'Connor
Dublin City University, roconnor@computing.dcu.ie

Ovsei Gelman
CCADET & Universidad Nacional Autónoma de México, ogelman@servidor.unam.mx

Jorge Macías-Luévano
Autonomous University of Aguascalientes, jeml@correo.uaa.mx

18P. CMMI (SW, DEV, SVC) Compliance of SDLCs: a Service System View

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Manuel Mora,
Autonomous University of Aguascalientes, Mexico
mmora@securenym.net

Rory V. O'Connor,
Dublin City University, Ireland,
roconnor@computing.dcu.ie

Ovsei Gelman,
CCADET & Universidad Nacional Autónoma de México, Mexico
ogelman@servidor.unam.mx

Jorge Macías-Luévano,
Autonomous University of Aguascalientes, México,
jeml@correo.uaa.mx

Abstract
In this paper a high-level strategic conceptual assessment on the extent of compliance of the three main Software Development Lifecycles (SDLCs) - STD, RUP, and MSF-CMMI, with three of the main CMMI schemes (SW, DEV, and SVC) is reported. While that the SDLCs theme is a permanent and shared topic in information systems and software engineering research, however, the compliance of SDLCs with IT standards has been few explored. Our research goal is to establish an initial high-level strategic assessment on how the most usual SDLCs satisfy three of the main CMMI schemes. Compliance analysis is based on: (i) previous results reported in literature, (ii) a comparison of the CMMI specific goals of each process area versus the generic SDLCs core workflows descriptions, and (iii) joint academic and research expertise in SW standards from authors. This paper contributes an initial assessment which should be considered from a strategic view due to the coarse unit of analysis. A finer grain analysis in the level of SLDCs' workflows and activities versus CMMI's specific practices and typical work products is suggested.

Keywords
IT service systems, process standards/models, software engineering, CMMI®, RUP®, MSF®, systems approach

1. Introduction
It has been well reported that an emergent service paradigm (Chesbrough & Spohrer, 2006) has been identified as highly relevant for theory and practice in different management, engineering, and basic sciences domains. Information systems and software engineering discipline are not outside of these service paradigm impacts (Zhao et al. 2007; Kontogiannis et al. 2007). In the last 10 years, IT service management has been emerged as a critical

theme for research and practice, given its relevance in modern organizations (Rai & Sambamurthy, 2006).

Under such a service orientation, we consider that the theoretical and practical relevance of developing business services, business service systems, and IT-based business service systems is high. We can define - based on Spohrer (2008) - an IT-based service system as a systemic configuration of resources (people, information, IT, other technology, infrastructure, products, and processes) for co-realizing a value proposition between providers and customers. However, in order to these IT-based service systems can be engineered and managed by software and system engineers and managers, are required process models focused on service systems.

However, despite the availability of service management models (ITIL v2, ITIL v3, and ISO/IEC 20000), these do not provide a specific well-defined development methodology for IT-based service systems, as it is available for normal IT-based systems. In contrast, the software and systems engineering domains have provided well-tested schemes such CMMI constellations, and two well-tested SDLCs like Unified Process (RUP©) and MSF©.

Hence, given that such SDLCs plus STD (Yourdon, 1990) are the most known and used also in IT communities and given the vast and complex number of involved concepts for this analysis, we pursue the research goal to establish an initial assessment on the extent of compliance of these main SDLCs (STD, Unified Process (RUP©), and MSF©) with the three current CMMI© schemes (SwE v1.1, DEV v1.2, and SVC v1.2) under the context of IT service systems. Compliance analysis is based on: (i) previous results reported in literature, (ii) a comparison of the CMMI specific goals of each process area versus the generic SDLCs core workflows descriptions, and (iii) a 15-year joint academic and research expertise in SwE standards from authors. We claim that this paper contributes with an initial assessment still not reported in literature (in high or detailed level), which must be considered only from a strategic view because the used coarse unit of analysis. A finer analysis in the level of SLDCs' workflows and activities versus CMMI's specific practices and typical work products will be completed in the next stage of this research.

We continue the paper as follows: in Section 2, we describe the foundations of service systems and IT-based service systems. In Section 3, we describe the three CMMI schemes and three software and system development methodologies (SDLCs) under study. In Section 4, we report the assessment process, and their results. In section 5, we finalize with conclusions, contributions, limitations, and the main recommendations for further research.

2. Foundations of Service Systems and IT-based Service Systems

2.1 The Concept of Service

There are several definitions of service systems, and for their main constituents: service and system. Spohrer et. al. (2007, p. 72) (based on Vargo and Lusch, 2004) define services as "*…the application of competences for the benefit of another, meaning that service is a kind of action, performance, or promise that's exchanged for value between provider and client.*". In Spohrer (2009, p. 6), a service is defined as "*…the application of resources (including competences, skills, and knowledge) to make changes that have value for another (system).*" From both conceptualizations, Mora et al. (2009) identifies that "… *a service can be initially* *mapped to: (i) an agreed integrated flux of actions (outputs' system) delivered by a provider system to a customer system to co-create value (Spohrer et. al 2007's view), and to (ii) a status property in the customer service that is affected by the delivered provider's system actions (Spohrer 2009's view)*". Furthermore, authors (2009) based on a Systems Approach and previous core research on services, define a service as a 3-dimensional concept as follows:

- *Services as a set of valued and agreed, expected and realized interactions between providers and customers (called facilitator and appraiser (sub) systems).*
- *Services as objectives outputs on both providers and customers which are valued expected change of status variables or attributes.*
- *Services as valued and expected short, middle and long-term consequences (outcomes) in both providers and customers.*

Hence, while this service conceptualization implicitly supports the initial notions of services as intangible and non-storable business items, fits the new Vargo and Lusch's (2004) and Spohrer's (2008) service-based logic view.

2.2 The Concept of Service System.

In contrast to service concept where there are several conceptualizations reported in the literature, the service system concept has been most implicitly used without an explicit definition. Spohrer et al. (2007, p. 72) define a service system as "…*a value coproduction configuration of people, technology, other internal and external service systems, and shared information (such as language, processes, metrics, prices, policies, and laws).*" Tien (2008, p. 150) define a service system as "… *a combination or recombination of three essential components —people (characterized by behaviors, attitudes, values, etc.), processes (characterized by collaboration, customization, etc.) and products (characterized by software, hardware, infrastructures, etc.).*" Furthermore, this author suggests that a system of systems (SoS) configuration view is more suitable for analyzing and defining a service system.

In concordance with these conceptualizations and given that a service system is firstly a system, in this paper, we support the Mora et al. (2009) definition of a service system as a system comprised of provider and customer (e.g. the Tien's system of systems view) instead of the usual view of the service system as uniquely the provider organization. According to authors (2009) a service system, thus have two core components: (i) a *service facilitator* sub-system (e.g. the original service provider), and (ii) a *service appraiser* subsystem (e.g. the initial user's system). An initial critical implication of this re-conceptualization is on co-responsibility in services failures. It because these ones can be caused by deviations on the agreed behaviors not only from the *service facilitator* subsystem –like be assigned in the classic view -, but also from mistakes into the *service appraiser* subsystem. Authors denote this service system as a ***service-fα system,*** and for *service facilitator and service appraiser* subsystems use the labels ***service-f*** and ***service-α*** subsystems. From authors (2009), following notations are also used:

- ***service-f(f1,f2,…)*** and ***service-α(α1, α2,…)*** stand by service as a flux of actions
- ***service-f(sf)*** and ***service-α(sα)*** stand by service as properties
- ***service-fα**** stands by service as the system's outcome.

Hence, in this paper, we also support the following definitions (from Mora et al. 2009, p. 46):

- ***a service-f system*** *as a system designed for delivering* ***service-f(f1,f2,…)*** *actions toward, and receiving* ***service-α(α1, α2,…)*** *actions from, a service-α system, with the purpose to mutually generate an expected outcome called* ***service-fα**** *and affect positively two properties called* ***service-f(sf)*** *and* ***service-α(sα)****.*
- ***a service- α system*** *as a system existent for receiving* ***service-f(f1,f2,…)*** *actions from, and delivering* ***service-α(α1, α2,…)*** *actions toward, a service-f system, with the purpose to mutually generate an expected outcome called* ***service-fα**** *and affect positively two properties called* ***service-f(sf)*** *and* ***service-α(sα)****.*
- ***a service-fα system*** *is a system comprised of a service-f sub-system and a service-α sub-system, with the purpose to mutually generate an expected value outcome called service-fα*, and which operates into a suprasystem and an environment.*
- ***a service-fα**** *is an expected people-oriented and valued outcome (which can be complemented by objective machines-oriented metrics), from a* ***service-fα system,*** *under an implicit or explicit agreement of its service-f and service-α sub-systems during a well-delimited period.*
- ***a service-α(sα)*** *is a service-α system's property expected to be positively affected by the* ***service-f(f1,f2,…)*** *and its* ***service-α(α1, α2,…)*** *actions, under an implicit or explicit agreement of such service-f and service-α sub-systems during a well-delimited period.*
- ***a service-f(sf)*** *is a service-f system's property expected to be positively affected by the* ***service-α(α1, α2,…)*** *and its* ***service-f(f1,f2,…)*** *actions, under an implicit or explicit agreement of such service-f and service-α sub-systems during a well-delimited period.*

2.3 The Concepts of IT Service and IT-based Service System

In IT literature, the concept of IT service is not new (Lewis, 1976). However, it modern service-based logic view has not been commonly used in most the literature except by the ITIL/ITSM stream (OGC, 2007). ITSM stands by *Information Technology Service Management*. This service approach to manage the whole IT organizational function was started by the British Central Computer and Telecommunications agency (CCTA) (now Office of Government Commerce) (van Von et al. 2006; OGC, 2007). ITSM pursues the shift focus on IT products toward IT services. ITIL (*Information Technology Infrastructure Library*) is an ITSM *de facto* standard. ITSM *de jure* standards are BS 15000 and ISO 20000:2005 (ISO 2005a, 2005b). In turn, ITIL 2.0:2002 has been recently updated to ITIL 3.0:2007, through a re-organization of its service core macro-areas to a five services stages of a lifecycle view. While ITIL v.2.0:2002 model is more known than ITIL v.3.0:2007 and ISO 20000:2005 standard[i] (ISO, 2005a, 2005b), the three schemes support the ultimate goal to improve the organizational business process (including the own IT process) via the provision of high quality IT services.

OGC (2007, p.5) for ITIL v3 defines services as "*delivering value to customers by facilitating outcomes customers want to achieve without the ownership of specific costs and risks",* and IT service as "*…a service provided to one or more customers by an IT service provider. An IT service is based on the use of Information Technology and supports the customer's business processes. An IT service is made up from a combination of people, processes and technology and should be defined in a Service Level Agreement*." Furthermore, the ITIL v.3 service design approach "*consider all aspects* (business process, service, SLA/SLR/OLA's, infrastructure, environment, data, applications, support services, support teams and suppliers) *when designing service solutions to meet new and evolving business needs*" (OGC, 2007, p. 24). Such a process and service-oriented perspective to manage the IT organizational function, has emerged directly from industries. Its consideration in academic IS settings is still starting (Zhao et al. 2007; Beachboard et al. 2007). In contrast, in the computing arena, the early apparition of the service-oriented computing model and computing tools (Bieberstein et al. 2005; Kontogiannis et al. 2007) suggests a greater focus of attention on such a new service paradigm. However, as Kontogiannis et. al. (2007, p.2) alert there are a variety of conceptualizations of IT services in the Software Engineering, IT Service Management and Business User domains. For instance Bieberstein et al. (2007, p1) define a service-oriented system as an IT-based system which is built via an "… *approach to software development where services provide reusable functionality with well-defined interfaces*". From a more focused computing-oriented SwE literature (W3C, 2004, p. 13) the concept of service can be defined as "*an abstract resource that represents a capability of performing tasks that form a coherent functionality from the point of view of provider entities and requester entities. To be used, a service must be realized by a concrete provider agent.*" Concepts related to this service concept are: service interfaces, message, operation, orchestration, choreography, and SOA (service-oriented architecture).

Hence, while the service and web service concepts have been defined in SwE literature, IT-based service systems, or even service system is not reported. Thus, to integrate such disparate perspectives on IT-based service systems is required. Kontogiannis et al. (2007) suggest the need of a strategy service function that links the organizational problem space with the business, engineering and IT management solution space. Other researchers (Zhao et al. 2007; Beachboard et al. 2007; Mora et al. 2009) support also such an integration.

With previous conceptualizations, in this paper, we support the Mora et al. (2009) definition of an IT service system as "*a system for delivering IT services to support a business function, business process or business service, which is comprised of IT service components and where utility and warranty are well-defined attributes*". In turn, an IT service component is "*a reusable entity with a useful functionality to assembly an IT service which uses IT service resources (people, technology (H/W, S/W, DBMS, Networks), data, applications, and entourage)*". Under such a service-based paradigm, the development of IT-based service systems demands focused process models and specific systems development methodologies.

3. Description of CMMI Schemes (SwE, DEV and SVC) and SLDCs (SA&D, RUP©, and MSF© for CMMI©)

IT-based organizational systems which have been developed are dominated by the use of Structured Cycle (STD) (Yourdon, 1990) during the 1980s and 1990s, and through Rational Unified Process (RUP®) (Gallagher & Brownsword, 2001) and Microsoft System Foundations for CMMI (MSF®) (Microsoft, 2008) lifecycles from late 1990s to present.

The Structured Cycle (Yourdon, 1990) is an SLDC with the following phases and activities: ***Survey, Systems Analysis, Design, Implementation, Acceptance Test Generation, Quality Assurance, Procedure Description, Database Conversion, and Installation***. In Survey, core users, problems, scope, goals, economic, technical and organizational feasibility study, and a project charter are realized. In Systems Analysis, an environmental model(purpose, context diagram, and event list), a behavioral model (data-flow diagrams, mini-specifications, data dictionary, and E-R diagram), and an user implementation model are developed. This represents a structured specification of the general user requirements identified in Survey activity. In Design, the user implementation model is refined, and a system implementation model (processor and task models), and a program implementation model are realized (structure charts). In Implementation, the codification and integration of modules is realized. In Acceptance Test Generation, a set of user suitable test cases is generated. In Quality Assurance the acceptance tests are applied. In Procedure Description, the complementary manual activities are described in a User's Manual. In some projects, the Database Conversion activity refers to additional tasks to deploy a new database or make the transition from some version to another one. Finally, in Installation the system is deployed in the organization.

Unified Process (Rational Unified Process, RUP®) (Gallagher & Brownsword, 2001), is a two dimensional SLDC of phases and core workflows. Phases are: Inception, Elaboration, Construction, and Transition. Core workflows are: ***Business Modeling, Requirements, Analysis & Design, Implementation, Test, Deployment, Project Management, Configuration & Change Management, and Environment***. In RUP©, in each phase one or more iterations on the core workflows are executed. However, while some workflows are realized with similar intensity (like Project Management), others are focused in some phases (like Business Modeling focused on Inception phase and partially in Elaboration one). In Inception phase, a feasible project must be elaborated (e.g. via Lifecycles Objectives). In Elaboration phase, engineering specifications for building and testing it (e.g. via a Lifecycle Architecture). In Construction phase the components are build and integrated in the full system (e.g. via the Initial Operational Capability). Finally, in Transition phase the product is released usually in several iterations which permit make final corrections and tuning of it (e.g. via a Product Release).

Microsoft System Foundations for CMMI (MSF®) (Microsoft, 2008) is an alternative SDLC to RUP©. MSF© for CMMI is organized in seven tracks (five technical and two managerial ones) and seven team groups. Tracks are groups of workstreams and activities. Tracks can be executed simultaneously, and into them can be performed several iterations (cycles) which address different levels (check-in, daily build, accepted build, iteration, project, and as needed). Technical tracks in MSF© are: Envision, Planning, Build, Stabilize and Deploy. Managerial tracks are: Governance, and Operational Management. Team groups are divided in: Program Management, Architecture, Development, Test, Release Management, User Experience, and Product Management. These team groups participate with different intensive levels in the seven tracks. MSF© consulted documents do not report a mapping to RUP© but according to Traa (2008) MSF© tracks can be partially mapped to RUP© phases and team groups (e.g. as responsible of activities) with RUP© core workflows. In Envision track the vision of the product is formulated and a project process is established. In Planning track the functional specifications of the system, the risk management plan, and the master project plan are developed. In Build track analysis and development, build products, and test cases are developed. In Stabilize track are built and corrected the products until a stable version. In Deploy, a project database, documentation, and final release version are developed. In Governance track, all quality entry and checks are performed. Finally, in Operational Management track a project, risk, and change management workstreams are executed.

4. Conceptual Analysis of Compliance of SLDCs (SA&D, RUP©, and MSF© for CMMI©) to CMMI Schemes (SwE, DEV and SVC) and

In this paper, we pursue the research goal to assess an initial high-level view compliance from aforementioned SDLCs with three main CMMI schemes (SwE v1.1 (SEI, 2002; DEV v1.2 (SEI, 2006) and SVC v1.2 (SEI, 2009)). Given the high conceptual density of such CMMI schemes, a conceptual research method (Mora et al. 2008) is conducted jointly with a Systems Approach (Gelman et al. 2005). A systemic description of the three CMMI schemes was elaborated by main author (Mora et al. 2007). Tables 1 and 2 report the structural description (by using Systemic Proformas (Andoh-Baidoo et al. 2004)) for CMMI-DEV and CMMI-SVC versions. For instance, in CMMI-SCV (SEI, 2009) there are 24 process areas (grouped in four categories), with five maturity levels (staged model) through an organization must transit. Initial level implies none planned or standardized practice and none area pre-defined even though these ones can exist in the organization. From the second to five level, several generic and specific goals, as well as generic and specific practices are required and expected to be achieved. For example, to achieve the level two 8 process area, 1 generic goal (GG2), 10 generic practices (GP2.1, GP2.2, …, GP.2.10), 18 specific goals and 63 specific practices must be addressed.

Our compliance analysis is based on: (i) previous results reported in SDLC documents and two previous comparisons for RUP® (Gallagher & Brownsword, 2001) and MSF® (Microsoft, 2008) on CMMI, as well as on a comparison between RUP® and MSF® (Traa, 2008), (ii) a comparison of the CMMI specific goals of each process area versus the generic SDLCs core workflows descriptions, and (iii) a 15-year joint academic and research expertise in SwE standards and 5-year using conceptual research from authors.

Demographic characteristics from evaluators (authors) is the following: (i) {PhD in Systems Engineering, 10 years in SwE graduate teaching, 7 years in SwE research on comparison of standards, member of Mexican ISO JTC1/SC7 Software Engineering committee, 10 years using conceptual research method (and co-designer of it)}; (ii) {PhD in Computer Sciences, 10 years in SwE graduate teaching, 7 years in SwE research on comparison of standards, 3 years using conceptual research method, member of international ISO JTC1/SC7 Software Engineering committee}, (iii) {PhD in Physics, 39 years in research in graduate teaching in systems engineering, co-designer of the conceptual research method}, and (iv) {MSc. in Information Technology, 5 years in SwE graduate teaching, 15 years in SwE consulting practice, 1 year using conceptual research method}.

The assessment was conducted through the following tasks: (T1) main author generated three comparison matrix and fills up with the CMMI specific goals of each process area versus the descriptions of the main core workflows of each SDLC. Each cell was assessed with 1when the SDLC's workflow/workstream description provided a clear evidence of supporting for the related (in column) specific goal of the CMMI analyzed. When this support was partial or indirect, 1/3 was assigned, and a 0 value when was identified a minimal or a null support. For each specific goal (column) was calculated the number of total points (clear or partial evidences of support) and two indexes were calculated as follows: (i) a balance index as the sum of the fractions of the differences between the number of evidences provided by the SDLC workflow of this specific goal less the average number of evidences by specific goal divided by latter number, and (ii) a completeness index as the average of the fractions

CMMI-DEV v.1.2 2006 (without IPPD) (Continuous and Staged Representations)	**A Capability Maturity Model (like CMMI-DEV v.1.2)** *"…contains the essential elements of effective processes for one or more disciplines and describes an evolutionary improvement path from ad hoc, immature processes to disciplined, mature processes with improved quality and effectiveness."* **(p. 9).** CMMI-DEV *"… is a reference model that covers the development and maintenance activities applied to both products and services"* (p. 8). CMMI-DEV (without IPDD) v.1.2 has 22 process areas.		
Capability Level Maturity Level	*"Achievement of process improvement within an individual process area. A capability level is defined by the appropriate specific and generic practices for a process area"* **(SEI Glossary, 2006).** *"Degree of process improvement across a predefined set of process areas in which all goals within the set are attained."* **(SEI Glossary, 2006).**	**L0: Incomplete (C)**	**Continuous Model:** **PA(none predefined set given several processes are incomplete or not performed), GG(0), GP(0), SG(0), SP(0)**
		L1: Performed (C) / Initial (S)	**Continuous Model:** **PA(user predefined set), GG(1), GP(1), SG(0), SP(0)** **Staged Model:** **PA(none predefined set), GG(0), GP(0), SG(0), SP(0)**
		L2: Managed (C, S)	**Continuous Model:** **PA(7), GG(2*), GP(11*), SG(15), SP(56)** **Staged Model:** **PA(7), GG(1), GP(10), SG(15), SP(56)**
		L3: Defined (C, S)	**Continuous Model:** **PA(11), GG(3*), GP(13*), SG(25), SP(85)** **Staged Model:** **PA(11), GG(2*), GP(12*), SG(25), SP(85)**
		L4: Quantitatively Managed (C, S)	**Continuous Model:** **PA(2), GG(4*), GP(15*), SG(3), SP(13)** **Staged Model:** **PA(2), GG(2*), GP(12*), SG(3), SP(13)**
		L5: Optimizing (C, S)	**Continuous Model:** **PA(2), GG(5*), GP(17*), SG(4), SP(12)** **Staged Model:** **PA(2), GG(2*), GP(12*), SG(4), SP(12)**
Process Area	*"A process area is a cluster of related practices in an area that, when performed collectively, satisfy a set of goals considered important for making significant improvement in that area."* **(SEI, 2006, p. 18)**	**Process Management (5 processes) :** *"contain the cross-project activities related to defining, planning, resourcing, deploying, implementing, monitoring, controlling, appraising, measuring, and improving processes."* **[OPF, OPD, OT, OPF, OID]**	
		Project Management (6 processes): *"cover the project management activities related to planning, monitoring, and controlling the project."* **[PP, PMC, SAM, IPM, RSKM, QPM]**	
		Engineering (6 processes): *"cover the development and maintenance activities that are shared across engineering disciplines (e.g., systems engineering and software engineering."* **[RD, RM,TS, PI, VER, VAL]**	
		Support (5 processes): *"cover the activities that support product development and maintenance."* **[CM, PP&QA, MA, DAR, CAR]**	
Generic Goal (required component) + & Generic Practices (expected components)	*"Generic goals are called "generic" because the same goal statement applies to multiple process areas. A generic goal describes the characteristics that must be present to institutionalize the processes that implement a process area. A generic goal is a required model component and is used in appraisals to determine whether a process area is satisfied."*. **(SEI, 2006, p. 19)** + *"Generic practices are called "generic" because the same practice applies to multiple process areas. A generic practice is the description of an activity that is considered important in achieving the associated generic goal. A generic practice is an expected model component."* **(SEI, 2006, p. 21)**	**L1**	**Continuous Model:** **GG1: "Achieve specific goals (of the performed processes)" ("*Institutionalize a Performed Process*").** **GP 1.1 Perform Specific Practices** (informal, undocumented, discretionary, but with visible inputs and outputs).
		L2	**Continuous Model:** **GG1 + GP 1.1 +** **Staged Model:** **GG2:** *"Institutionalize a Managed Process"* + **GP 2.1 Establish an Organizational Policy** **GP 2.2 Plan the Process** **GP 2.3 Provide Resources** **GP 2.4 Assign Responsibility** **GP 2.5 Train People** **GP 2.6 Manage Configurations** **GP 2.7 Identify and Involve Relevant Stakeholders** **GP 2.8 Monitor and Control the Process** **GP 2.9 Objectively Evaluate Adherence** **GP 2.10 Review Status with Higher Level Management**
		L3	**Continuous Model:** **GG1 + GP 1.1 +** **Staged Model:** **GG2 +** **GG3:** *"Institutionalize a Defined Process"* + **GP 2.1 TO GP 2.10 +** **GP 3.1 Establish a Defined Process** **GP 3.2 Collect Improvement Information**
		L4	**Continuous Model:** **GG1 + GP 1.1 +** **Staged Model:** **GG2 + GG3 +** **GP 2.1 TO GP 2.10 + GP 3.1 + GP 3.2 +** **Continuous Model:** **GG4:** *"Institutionalize a Quantitatively Managed Process"* + **GP 4.1 Establish Quantitative Objectives for the Process** **GP 4.2 Stabilize Subprocess Performance**
		L5	**Continuous Model:** **GG1 + GP 1.1 +** **Staged Model:** **GG2 + GG3 +** **GP 2.1 TO GP 2.10 + GP 3.1 + GP 3.2 +** **Continuous Model:** **GG4 + GP 4.1 + GP 4.2 +** **GG5:** *"Institutionalize an Optimizing Process"* **GP 5.1 Ensure Continuous Process Improvement** **GP 5.2 Correct Root Causes of Problems**
Specific Goal (required component) & Specific Practices (expected components)	*"A specific goal describes the unique characteristics that must be present to satisfy the process area. A specific goal is a required model component and is used in appraisals to help determine whether a process area is satisfied."* **(SEI, 2006, p. 19)** + *"A specific practice is the description of an activity that is considered important in achieving the associated specific goal. The specific practices describe the activities that are expected to result in achievement of the specific goals of a process area. A specific practice is an expected model component."* **(SEI, 2006, p. 20)**	**L2 Staged Processes**	**PROCESS MANAGEMENT: 0/5** **• None** **PROJECT MANAGEMENT: 3/6** **• Project Planning= SG(SP)=(4,7,3)** **• Project Monitoring and Control= SG(SP)=(7,3)** **• Supplier Agreement Management= SG(SP)=(3,5)** **ENGINEERING: 1/6** **• Requirements Management = SG(SP)=(5)** **SUPPORT: 3/5** **• Configuration Management= SG(SP)= (3,2,2)** **• Process & Product Quality Assurance= SG(SP)=(2,2)** **• Measurement and Analysis= SG(SP)=(4,4)**
		L3 Staged Processes	**PROCESS MANAGEMENT: 3/5** **• Organizational Process Focus= SG(SP)=(3,2,4)** **• Organizational Process Definition= SG(SP)=(5)** **• Organizational Training= SG(SP)=(4,3)** **PROJECT MANAGEMENT: 2/6** **• Integrated Project Management= SG(SP)=(5,3)** **• Risk Management= SG(SP)=(3,2,2)** **ENGINEERING: 5/6** **• Requirements Development = SG(SP)=(2,3,5)** **• Technical Solution= SG(SP)=(2,4,2)** **• Product Integration= SG(SP)=(3,2,4)** **• Verification= SG(SP)=(3,3,2)** **• Validation= SG(SP)=(3,2)** **SUPPORT: 1/5** **• Decision Analysis and Resolution= SG(SP)=(6)**
		L4 Staged Processes	**PROCESS MANAGEMENT: 1/5** **• Organizational Process Performance= SG(SP)=(5)** **PROJECT MANAGEMENT: 1/6** **• Quantitative Project Management= SG(SP)=(4,4)**
		L5 Staged Processes	**PROCESS MANAGEMENT: 1/5** **• Organizational Innovation and Deployment SG(SP)=(4,3)** **SUPPORT: 1/6** **• Causal Analysis and Resolution SG(SP)=(2,3)**

Table 1: CMMI-DEV v1.2 Systemic Description

CMMI-SVC, v1.2 (Continuous and Staged Representations)	**A Capability Maturity Model (like CMMI-SVC v.1.2)** "*contains the essential elements of effective processes for one or more disciplines. It also describes an evolutionary improvement path from ad hoc, immature processes to disciplined, mature processes with improved quality and effectiveness.*" In particular for service systems CMMI-SVC v1.2 covers "*… the activities required to establish, deliver, and manage services.*" CMMI-SVC contains 24 process areas (16 processes come from CMMI Model Foundation (CMF) process areas, 7 processes from service-specific process areas, and 1 process is new).		
Capability Level Maturity Level	"*Achievement of process improvement within an individual process area. A capability level is defined by appropriate specific and generic practices for a process area.*" **(SEI Glossary, 2009).** "*Degree of process improvement across a predefined set of process areas in which all goals within the set are attained.*" **(SEI Glossary, 2009).**	**L0: Incomplete (C)**	**Continuous Model:** **PA(none predefined set given several processes are incomplete or not performed), GG(0), GP(0), SG(0), SP(0)**
		L1: Performed (C) / Initial (S)	**Continuous Model:** **PA(user predefined set), GG(1), GP(1), SG(0), SP(0)** **Staged Model:** **PA(none predefined set), GG(0), GP(0), SG(0), SP(0)**
		L2: Managed (C, S)	**Continuous Model:** **PA(7), GG(2*), GP(11*), SG(18), SP(63)** **Staged Model:** **PA(7), GG(1), GP(10), SG(18), SP(63)**
		L3: Defined (C, S)	**Continuous Model:** **PA(11), GG(3*), GP(13*), SG(26), SP(86)** **Staged Model:** **PA(11), GG(2*), GP(12*), SG(26), SP(86)**
		L4: Quantitatively Managed (C, S)	**Continuous Model:** **PA(2), GG(4*), GP(15*), SG(3), SP(13)** **Staged Model:** **PA(2), GG(2*), GP(12*), SG(3), SP(13)**
		L5: Optimizing (C, S)	**Continuous Model:** **PA(2), GG(5*), GP(17*), SG(4), SP(12)** **Staged Model:** **PA(2), GG(2*), GP(12*), SG(4), SP(12)**
Process Area	"*A process area is a cluster of related practices in an area that, when performed collectively, satisfy a set of goals considered important for making significant improvement in that area.*" **(SEI, 2009, p. 10)**	**Process Management (5):** "*contain the cross-project activities related to defining, planning, resourcing, deploying, implementing, monitoring, controlling, appraising, measuring, and improving processes.*" **[OPF, OPD, OT, OPF, OID]**	
		Project/Service Management (9): "*cover the project management activities related to planning, monitoring, and controlling the project.*" **[PP, PMC, SAM, IPM, RSKM, QPM, REQM, SCON, CAM]**	
		Service Establishment and Delivery (5): "*cover the development and maintenance activities that are shared across engineering disciplines (e.g., systems engineering and software engineering.*" **[IRP, SD, SSD, SST, STSM]**	
		Support (5): "*cover the activities that support product development and maintenance.*" **[CM, PP&QA, MA, DAR, CAR]**	
Generic Goal (required component) + & Generic Practices (expected components)	**"goals** *are called "generic" because the same goal statement appears in multiple process areas. In the staged representation, each process area has only one generic goal. … thus indicating whether these processes are likely to be effective, repeatable, and lasting* **" (SEI, 2009, p. 12)** + "*Generic practices are called "generic" because the same practice applies to multiple process areas. A generic practice is the description of an activity that is considered important in achieving the associated generic goal. A generic practice is an expected model component.*" **(SEI, 2009, p. 14)**	**L1**	**Continuous Model:** **GG1: "Achieve specific goals (of the performed processes)" ("*Institutionalize a Performed Process*").** **GP 1.1 Perform Specific Practices** (informal, undocumented, discretionary, but with visible inputs and outputs).
		L2	**Continuous Model:** **GG1 + GP 1.1 +** **Staged Model:** **GG2:** "*Institutionalize a Managed Process*" + **GP 2.1 Establish an Organizational Policy** **GP 2.2 Plan the Process** **GP 2.3 Provide Resources** **GP 2.4 Assign Responsibility** **GP 2.5 Train People** **GP 2.6 Manage Configurations** **GP 2.7 Identify and Involve Relevant Stakeholders** **GP 2.8 Monitor and Control the Process** **GP 2.9 Objectively Evaluate Adherence** **GP 2.10 Review Status with Higher Level Management**
		L3	**Continuous Model:** **GG1 + GP 1.1 +** **Staged Model:** **GG2 +** **GG3:** "*Institutionalize a Defined Process*" + **GP 2.1 TO GP 2.10 +** **GP 3.1 Establish a Defined Process** **GP 3.2 Collect Improvement Information**
		L4	**Continuous Model:** **GG1 + GP 1.1 +** **Staged Model:** **GG2 + GG3 +** **GP 2.1 TO GP 2.10 + GP 3.1 + GP 3.2 +** **Continuous Model:** **GG4:** "*Institutionalize a Quantitatively Managed Process*" + **GP 4.1 Establish Quantitative Objectives for the Process** **GP 4.2 Stabilize Subprocess Performance**
		L5	**Continuous Model:** **GG1 + GP 1.1 +** **Staged Model:** **GG2 + GG3 +** **GP 2.1 TO GP 2.10 + GP 3.1 + GP 3.2 +** **Continuous Model:** **GG4 + GP 4.1 + GP 4.2 +** **GG5:** "*Institutionalize an Optimizing Process*" **GP 5.1 Ensure Continuous Process Improvement** **GP 5.2 Correct Root Causes of Problems**
Specific Goal (required component) & Specific Practices (expected components)	"*A specific goal describes the unique characteristics that must be present to satisfy the process area. A specific goal is a required model component and is used in appraisals to help determine whether a process area is satisfied.*" **(SEI, 2009, p. 12)** + "*A specific practice is the description of an activity that is considered important in achieving the associated specific goal. The specific practices describe the activities that are expected to result in achievement of the specific goals of a process area. A specific practice is an expected model component.*" **(SEI, 2009, p. 13)**	**L2 Staged Processes**	**PROCESS MANAGEMENT: 0/5** **- None** **PROJECT/SERVICE MANAGEMENT: 4/9** **- Project Planning= SG(SP)=(4,7,3)** **- Project Monitoring and Control= SG(SP)=(7,3)** **- Supplier Agreement Management= SG(SP)=(3,4)** **- Requirements Management = SG(SP)=(5)** **SERVICE ESTABLISHMENT AND DELIVERY: 1/5** **- Service Delivery = SG(SP)=(2,3,3)** **SUPPORT: 3/5** **- Measurement and Analysis= SG(SP)=(4,4)** **- Process & Product Quality Assurance= SG(SP)=(2,2)** **- Configuration Management= SG(SP)= (3,2,2)**
		L3 Staged Processes	**PROCESS MANAGEMENT: 3/5** **- Organizational Process Focus= SG(SP)=(3,4)** **- Organizational Process Definition= SG(SP)=(5)** **- Organizational Training= SG(SP)=(4,3)** **PROJECT/SERVICE MANAGEMENT: 4/9** **- Integrated Project Management= SG(SP)=(5,3)** **- Risk Management= SG(SP)=(3,2,2)** **- Capacity and Availability Management= SG(SP)=(3,3)** **- Service Continuity = SG(SP)=(2,3,3)** **SERVICE ESTABLISHMENT AND DELIVERY: 4/5** **- Incident Resolution and Prevention (IRP) = SG(SP)=(2,6,3)** **- Service System Development = SG(SP)=(3,5,4)** **- Service System Transition = SG(SP)=(3,2)** **- Strategic Service Management = SG(SP)=(2,2)** **SUPPORT: 1/5** **- Decision Analysis and Resolution= SG(SP)=(6)**
		L4 Staged Processes	**PROCESS MANAGEMENT: 1/5** **- Organizational Process Performance= SG(SP)=(5)** **PROJECT/SERVICE MANAGEMENT: 1/9** **- Quantitative Project Management= SG(SP)=(4,4)**
		L5 Staged Processes	**PROCESS MANAGEMENT: 1/5** **- Organizational Innovation and Deployment SG(SP)=(4,3)** **SUPPORT: 1/5** **- Causal Analysis and Resolution SG(SP)=(2,3)**

Table 2: CMMI-SVC v1.2 Systemic Description

generated by dividing the number of evidences provided by each SDLC workflows by 2 (agreed number of expected evidences).

These indexes were used to assess the final compliance to each process area by each SDLC as follows: strong compliance (●) when the completeness index was at least of 75% and the balance index was at most 1.0, a middle compliance (◒) when the completeness index was at least of 50% and less than 75%, and the balance index was at most 1.0, and a weak or null compliance (○) when the completeness index was less than 50%. An overall assessment of each SDLC compliance with each maturity level in each CMMI scheme was realized as follows: a strong compliance (●) when the majority of each process area was assessed as strong and there were at most one process area with null support, a partial compliance (◒) when the majority of process areas are strongly supported but appears at least two ones with null support, an initial compliance (◉) when there an approximate number of process areas being and not being supported, and a null compliance (○) when the majority of the process areas are not supported.

A second review (T2) of all initial assessment was realized, and where appeared differences, a brief exchange of justifications were realized between both first and second evaluators. Finally (T3), third and fourth authors conducted a random sample-based verification by using original documents and evaluation matrixes. Where differences emerged, main and second authors verify it. As an example of this detailed assessment a partial view of the maturity level 2 CMMI-SwE analysis realized for the RUP© SDLC is reported in Table 3. Similar analyses were conducted for the remainder maturity levels, SDLCs and CMMI schemes. In Tables 4 to 6, we report the summarized results of this analysis.

CMMI-SW	MATURITY LEVEL 2 (GG2: Institutionalize a Managed Process)														
	Project Planning			Project Monitoring & Control		Supplier Agreement Management		Requirements Management	Configuration Management			Process & Product Quality Assurance		Measurement & Analysis	
	The purpose of Project Planning (PP) is to establish and maintain plans that define project activities.			The purpose of Project Monitoring and Control (PMC) is to provide an understanding of the project's progress so that appropriate corrective actions can be taken when the project's performance deviates significantly from the plan.		The purpose of Supplier Agreement Management is to manage the acquisition of products from suppliers for which there exists a formal agreement.		The purpose of Requirements Management (REQM) is to manage requirements of the project's products and product components and to identify inconsistencies between those requirements and the project's plans and work products.	The purpose of Configuration Management (CM) is to establish and maintain the integrity of work products using configuration identification, configuration control, configuration status accounting, and configuration audits.			The purpose of Process and Product Quality Assurance (PPQA) is to provide staff and management with objective insight into processes and associated work products.		The purpose of Measurement and Analysis (MA) is to develop and sustain a measurement capability used to support management information needs.	
CMMI SPECIFIC GOALS	SG 1 Establish Estimates	SG 2 Develop a Project Plan	SG 3 Obtain Commitment to the Plan	SG 1 Monitor the Project Against the Plan	SG 2 Manage Corrective Action to Closure	SG 1 Establish Supplier Agreements	SG 2 Satisfy Supplier Agreements	SG 1 Manage Requirements	SG 1 Establish Baselines	SG 2 Track and Control Changes	SG 3 Establish Integrity	SG 1 Objectively Evaluate Processes and Work Products	SG 2 Provide Objective Insight	SG 1 Align Measurement and Analysis Activities	SG 2 Provide Measurement Results
RUP CORE WORKFLOWS															
BUSINESS MODELING															
Assess Business															
Describe Current Business															
Identify Business Processes															
Refine Business Process Definitions															
Design Business Process Realizations															
Refine Roles and Responsibilities		1													
Explore Process Automation															
Develop a Domain Model															
REQUIREMENTS															
Analyze the Problem															
Understand Stakeholder Needs								1							
Define the System															
Manage the Scope of the System								1							
Refine the System Definition															
Manage Changing Requirements								1							
ANALYSIS & DESIGN															
Perform Architectural Synthesis															
Define a Candidate Architecture															
Refine the Architecture															
Analyze Behaviour															
Design Components															
Design the Database															
IMPLEMENTATION															
Structure the Implementation Model															
Plan the Integration															
Implement Components															
Integrate Each Subsystem															
Integrate the System															
TEST															
Define Evaluation Mission															
Verify Test Approach												1	1		
Validate Build Stability												1	1		
Test and Evaluate												1	1		
Achieve Acceptable Mission															
Improve Test Assets															
DEPLOYMENT															
Plan Deployment															
Develop Support Material															
Manage Acceptance Test															
Produce Deployment Unit															
Beta Test Product															
Package Product															
Provide Access to Download Site															
CONFIGURATION & MANAGEMENT															
Plan Project Configuration & Change Control									1	1	1				
Create Project Configuration Management (CM) Environments									1	1	1				
Manage Baselines & Releases									1						
Change and Deliver Configuration Items										1	1				
Monitor & Report Configuration Items										1	1				
Manage Change Requests										1	1				
PROJECT MANAGEMENT															
Conceive New Project	1														
Evaluate Project Scope and Risk		1													
Plan the Project	1	1	1												
Plan for Next Iteration			1												
Manage Iteration			1												
Monitor & Control Project				1	1							1	1	1	1
Close-Out Phase				1	1										
Close-Out Project				1	1										
ENVIRONMENT															
Prepare Environment for Project			1												
Prepare Environment for an Iteration															
Support Environment During an Iteration															
RUP WORKFLOWS LINKED TO CMMI SGs	2	3	4	3	3	0	0	3	3	5	5	4	4	1	1
POINTS			9		6		0	3			13		8		2
AVERAGE WFS BY SG			3.0		3.0		0.0	3.0			4.0		4.0		1.0
COMPLIANCE ANALYSIS															
* Balance of RUP WFs on CMMI SGs	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.0	0.0	1.0	0.0
			0.7		0.0		0.0	0.0			0.8		0.0		1.0
* Completeness of RUP WFs on CMMI SGs	100%	100%	100%	100%	100%	0%	0%	100%	100%	100%	100%	100%	100%	50%	50%
			100%		100%		0%	100%			100%		100%		50%
COMPLIANCE ASSESSMENT			●		●		○	●			●		●		◒

Table 3: Assessment of RUP© SDLC Compliance to CMMI-SW

CMMI-SWE 2002 STAGED				
PROCESS AREA	LEVEL 2: MANAGED	STD	RUP	MSF
PROJECT	Project Planning	●	●	●
PROJECT	Project Monitoring and Control	◒	●	●
PROJECT	Supplier Agreement Management	○	○	○
ENGINEERING	Requirements Management	◒	●	●
SUPPORT	Configuration Management	○	●	●
SUPPORT	Process and Product Quality Assurance	○	●	●
SUPPORT	Measurement and Analysis	○	◒	●
		○	●	●
PROCESS AREA	LEVEL 3: DEFINED	STD	RUP	MSF
PROCESS	Organizational Process Focus	○	○	●
PROCESS	Organizational Process Definition	○	◒	●
PROCESS	Organizational Training	○	○	◒
PROJECT	Integrated Project Management	○	●	●
PROJECT	Risk Management	○	●	●
ENGINEERING	Requirements Development	●	●	●
ENGINEERING	Technical Solution	●	●	●
ENGINEERING	Product Integration	●	●	●
ENGINEERING	Verification	●	●	●
ENGINEERING	Validation	●	●	●
SUPPORT	Decision Analysis and Resolution	○	○	○
		○	◒	●
PROCESS AREA	LEVEL 4: Q. MANAGED	STD	RUP	MSF
PROCESS	Organizational Process Performance	○	○	◒
PROJECT	Quantitative Project Management	○	○	◒
		○	○	◒
PROCESS AREA	LEVEL 5: OPTIMIZING	STD	RUP	MSF
PROCESS	Organizational Innovation and Deployment	○	○	○
SUPPORT	Causal Analysis and Resolution	○	○	○
		○	○	○

Table 4: Assessment of SDLCs Compliance to CMMI-SW

CMMI-DEV 2006				
PROCESS AREA	LEVEL 2: MANAGED	STD	RUP	MSF
PROJECT	Project Planning	●	●	●
PROJECT	Project Monitoring and Control	◒	●	●
PROJECT	Supplier Agreement Management	○	○	○
ENGINEERING	Requirements Management	◒	●	●
SUPPORT	Configuration Management	○	●	●
SUPPORT	Process and Product Quality Assurance	○	●	●
SUPPORT	Measurement and Analysis	○	◒	●
		○	●	●
PROCESS AREA	LEVEL 3: DEFINED	STD	RUP	MSF
PROCESS	Organizational Process Focus	○	○	●
PROCESS	Organizational Process Definition	○	◒	●
PROCESS	Organizational Training	○	○	◒
PROJECT	Integrated Project Management	○	●	●
PROJECT	Risk Management	○	●	●
ENGINEERING	Requirements Development	●	●	●
ENGINEERING	Technical Solution	●	●	●
ENGINEERING	Product Integration	●	●	●
ENGINEERING	Verification	●	●	●
ENGINEERING	Validation	●	●	●
SUPPORT	Decision Analysis and Resolution	○	○	○
		⦿	◒	●
PROCESS AREA	LEVEL 4: Q. MANAGED	STD	RUP	MSF
PROCESS	Organizational Process Performance	○	○	◒
PROJECT	Quantitative Project Management	○	○	◒
		○	○	◒
PROCESS AREA	LEVEL 5: OPTIMIZING	STD	RUP	MSF
PROCESS	Organizational Innovation and Deployment	○	○	○
SUPPORT	Causal Analysis and Resolution	○	○	○
		○	○	○

Table 5: Assessment of SDLCs Compliance to CMMI-DEV

CMMI-SVC 2009				
PROCESS AREA	LEVEL 2: MANAGED	STD	RUP	MSF
PROJECT-SERVICE MANAGEMENT	Project Planning	●	●	●
PROJECT-SERVICE MANAGEMENT	Project Monitoring and Control	◒	●	●
PROJECT-SERVICE MANAGEMENT	Supplier Agreement Management	○	○	○
PROJECT-SERVICE MANAGEMENT	Requirements Management	◒	●	●
SERVICE ESTABLISHEMENT AND DELIVERY	Service Delivery	○	◒	◒
SUPPORT	Configuration Management	○	●	●
SUPPORT	Process and Product Quality Assurance	○	●	●
SUPPORT	Measurement and Analysis	○	◒	●
		○	●	●
PROCESS AREA	LEVEL 3: DEFINED	STD	RUP	MSF
PROCESS	Organizational Process Focus	○	○	●
PROCESS	Organizational Process Definition	○	◒	●
PROCESS	Organizational Training	○	○	◒
PROJECT-SERVICE MANAGEMENT	Integrated Project Management	○	●	●
PROJECT-SERVICE MANAGEMENT	Risk Management	○	●	●
PROJECT-SERVICE MANAGEMENT	Capacity and Availability Management	○	○	○
PROJECT-SERVICE MANAGEMENT	Service Continuity	○	○	○
SERVICE ESTABLISHEMENT AND DELIVERY	Incident Resolution and Prevention	○	○	◒
SERVICE ESTABLISHEMENT AND DELIVERY	Service System Development	◒	●	●
SERVICE ESTABLISHEMENT AND DELIVERY	Service System Transition	○	◒	◒
SERVICE ESTABLISHEMENT AND DELIVERY	Strategic Service Management	○	○	○
SUPPORT	Decision Analysis and Resolution	○	○	○
		○	⦿	◒
PROCESS AREA	LEVEL 4: Q. MANAGED	STD	RUP	MSF
PROCESS	Organizational Process Performance	○	○	◒
PROJECT-SERVICE MANAGEMENT	Quantitative Project Management	○	○	◒
		○	○	◒
PROCESS AREA	LEVEL 5: OPTIMIZING	STD	RUP	MSF
PROCESS	Organizational Innovation and Deployment	○	○	○
SUPPORT	Causal Analysis and Resolution	○	○	○
		○	○	○

Table 6: Assessment of SDLCs Compliance to CMMI-SVC

From Tables 4 to 6, we can report the following findings: (i) the STD SDLC is unable to fit level 2 (and higher levels) in any CMMI scheme. Another two SDLCs (RUP® and MSF© for CMMI) are able to achieve maturity level 2 in all of the three CMMI schemes. In this level maturity level 2, while appears a new process area (called service delivery), our assessment for these two SLDCs was of middle support due to both SDLCs provide already a variety of practices oriented to web-based service systems. However, all issues demanded by an ITIL-alike approach are not still completed. (ii) Maturity level 3 is reached only by MSF© in CMMI-SW and CMMI-DEV schemes. RUP was assessed in middle level due to lack of support for three process areas in such schemes. When CMMI-SVC is considered, both SLDCs lack of important practices for the added process areas. However, MSF© performs better than RUP© in the remainder process areas. (iii) Maturity level 4 is partially reached by MSF© in all of the three CMMI schemes. It can be explained because CMMI-SVC does not add process areas to this level regarding previous CMMI schemes. (iv) Maturity level 5 is not reached by some of the SDLCs. (iv) In overall MSF© performs better than another SLDCs for a CMMI compliance. It can be related to the updated design approach being MSF part of the MOF scheme (e.g. an ITIL alike scheme), while that RUP© is not yet integrated with a potential similar scheme (e.g. ITUP). (v) SLDCs compliance to process frameworks (standards or models like CMMI) is a worthy organizational endeavor but due to the different purpose design and scope, its demands for fitting them must be carefully assessed. CMMI schemes are more comprehensive process frameworks which covers practically the core process of an organization. In contrast, SLDCs were designed only for guiding a systematic development process of an artifact (software in these cases). However, due to the organizations need to select a SDLC for their CMMI compliance, the selection of a SLDC which covers more CMMI process areas must reduce the organizational effort of a CMMI implementation.

Hence, the main implication for software and systems practitioners who could consider that the transition from CMMI-SW or CMMI-DEV to CMMI-SVC is seamless and fast is wrong. While that a CMMI-SW or CMMI-DEV compliance is useful, we hypothesize a CMMI-SVC implementation will demand still additional organizational efforts for achieving such a correct transition Finally, as CMMI-SVC document reports, it is based on ITIL v2, ITIL v3, and ISO/IEC 20000 schemes and consequently, a new and full IT Service Management view will be required. It is not used and demanded by CMMI-SwE and CMMI-DEV schemes at present.

5. Conclusions

We have performed a high-level conceptual analysis on the extent of compliant of three SDLCs (SA&D, RUP®, MSF® for CMMI) to three main CMMI schemes (SW, DEV and SVC). We have found that while the classic STD (structured cycle) is still very useful in the IS discipline, is insufficient to achieve the minimal expected maturity levels 2 and 3 of the three schemes. In contrast, modern SDLCs (RUP® and MSF® for CMMI) can comply (with few process additions) the levels 2 and 3 in both CMMI-SwE and CMMI-DEV schemes. However, when the new CMMI-SVC 2009 scheme is considered, both current versions of these modern SDLCs are insufficient to fully achieve a level 3 and higher ones. Hence, practitioners who consider a fast and easy transition from CMMI-DEC compliance to CMMI-SVC could be wrongly underestimate the strong organizational additional efforts required for such an aim. While our results are limited by the coarse level used in the unit of analysis, we claim this paper contributes with an initial high-level assessment on such SLDC CMMI compliance still not reported in literature. A finer analysis will be pursued in the future as part of the next stage of this research.

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